

Claims

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- [c1] 1. A method comprising:
 placing a first substrate with a first surface part that has better microwave absorption than said first substrate, against a second substrate with a second surface part that has better microwave absorption than said second substrate; aligning said first surface part with said second surface part; and applying microwave energy to the first and second parts to bond the first substrate to the second substrate.
- [c2] 2. A method as in claim 1, wherein the first substrate is placed on top of the second substrate, and is held only by gravity during bonding.
- [c3] 3. A method as in claim 1, wherein said bonding includes hermetically sealing a cavity.
- [c4] 4. A method as in claim 3, wherein said first and second parts each extend around a closed perimeter, and wherein said hermetically sealing comprises hermetically sealing along an entirety of said closed perimeter.
5. A method as in claim 2, wherein said first and second surface parts are metals.
- [c5] 6. A method as in claim 5, wherein said substrate is poorly microwave absorbing silicon.
- [c6] 7. A method as in claim 1, wherein said first substrate has an outer surface part formed of a material with a high imaginary dielectric constant ϵ'' .
- [c7] 8. A method, comprising:
 forming a first substrate having a poorly microwave absorbing material at a first portion and a thin film of better absorbing material at a second portion;
 forming a second substrate having a poorly microwave absorbing material, having a material at a first portion, and a thin film of better absorbing material at a second portion; and using microwave energy to bond the thin films.
- [c8] 9. A method as in claim 8, wherein said first substrate is held on the second substrate by gravity only.
10. A method as in claim 9, wherein the first substrate

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- includes an indented portion therein, and said bonding comprises hermetically sealing around a perimeter of the indented portion.
- [c9] 11 ~~11~~ A method, comprising:
- placing a first substrate of a first material, having a first area defined within a perimeter of a second material, against a second substrate, of the third material, said second substrate also having a second area defined within a perimeter of a fourth material, and wherein said first and third materials are poorer absorbers of microwaves than said second and fourth materials; and applying microwaves to an area of said first substrate and said second substrate to bond said second material to said fourth material.
- [c10] 12 ~~12~~ A method as in claim 11, wherein said first and third materials are semiconductor materials.
- [c11] 13 ~~13~~ A method as in claim 12, wherein said second and fourth materials are metal materials.
- [c12] 14 ~~14~~ A method as in claim 11, wherein said second and fourth materials define a perimeter with a closed shape.
- [c13] 15 ~~15~~ A method as in claim 14, further comprising forming a hermetically sealed cavity within said perimeter.
- [c14] 16 ~~16~~ A method as in claim 11, wherein said placing comprises placing one of said substrates on the top of the other of said substrates.
- [c15] 17 ~~17~~ A method as in claim 16, wherein said one and said other substrates are held together only by gravity during said bonding.
- [c16] 18 ~~18~~ A method as in claim 16, wherein said one and said other substrates are held together by an additional weight.
- [c17] 19 ~~19~~ A method as in claim 13, wherein said second and fourth materials are gold.
- [c18] 20 ~~20~~ A method as in claim 18, wherein said additional weight is sapphire.
- [c19] 21 ~~21~~ A device, comprising:

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a first substrate of a material that is a poor absorber of microwaves, having a first surface that is a better absorber of microwaves;

a second substrate of a material that is a poor absorber of microwaves, having a second surface that is a better absorber of microwaves that is aligned with the first surface;

said first and second surfaces, coupled together to define an area of connection therebetween.

- [c20] 22 ²⁰22. A device as in claim 21, wherein said material of said substrate is semiconductor material.
- [c21] 23 ²¹23. A device as in claim 21, wherein said first and second surfaces are metals.
- [c22] 24 ²²24. A device as in claim 21, wherein said metal has a thickness within an order of magnitude of the skin depth of the first and second surfaces.
- [c23] 25 ²³25. A device as in claim 21, wherein said area of connection forms a closed perimeter.
- [c24] 26 ²⁴26. A device as in claim 25, wherein said closed perimeter defines a hermetically sealed chamber.
- [c25] 27 ²⁵27. A device as in claim 26, wherein said hermetically sealed chamber holds a vacuum relative to the surround environment.
- [c26] 28 ²⁶28. A method, comprising:
 bringing a first semiconductor substrate with a first metal film into contact with
 to a second semiconductor substrate with a second metal film, where both said
 first and second metal films are less than an order of magnitude thicker than
 the skin depth of the metal; and
 applying microwaves to said first and second semiconductor substrates to bond
 said first metal film to said second metal film.
- [c27] 29 ²⁷29. A method as in claim 28, wherein said applying microwaves comprise
 applying microwave in a cylindrical cavity which is excited by a microwave
 source at the resonant frequency of a TM₀₁₀ mode.

- [c28] ³⁰ ~~28~~ 30. A method as in claim 28, wherein said first and second metal films formed one or more closed perimeters, and said applying microwaves carries out bonding of said first and second metal films in a way that forms a cavity within said first and second metal film.
- [c29] ³¹ ~~29~~ 31. A method as in claim 30, wherein said applying microwaves comprise applying microwaves within a chamber, and further comprising forming a vacuum within said chamber, to form a vacuum within said cavity after bonding.
- [c30] ³² ~~30~~ 32. A method as in claim 28, wherein at least one of said first and second substrates include electronic components thereon.
- [c31] ³³ ~~31~~ 33. A method as in claim 32, further comprising shielding said electrical components prior to said applying microwaves.
- [c32] ³⁴ ~~32~~ 34. A method as in claim 28, further comprising placing a plurality of samples on a conveyor, and taking said samples into an area of microwave fields.
- [c33] ³⁵ ~~33~~ 35. A method as in claim 16, wherein said placing includes aligning said first and second materials.